1996 Purple Loosestrife Survey and Control Activities

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This report summarizes the results of purple loosestrife surveys and evaluations of control methods that were carried out in 1996. The introduction presents a brief overview of purple loosestrife ecology, history, and its threat to native wetland communities. Chapter 1 reports the distribution of purple loosestrife in the 1842 ceded territory of Michigan. Chapter 2 documents the results of a study to quantify the effectiveness and efficiency of using backpack sprayers to apply Garlon 3A to control purple loosestrife.

INTRODUCTION

Purple loosestrife (*Lythrum salicaria*) was introduced into the United States in the early 1800's via ship ballast exchange, livestock bedding and forage, beekeepers, and as a medicinal herb by early settlers (Thompson et al. 1987). It spread rapidly through the eastern United States following travel corridors, primarily highways and waterways. By 1900 a purple loosestrife colony was documented in the upper peninsula of Michigan near Houghton (Stuckey 1980). Since then it has continued to spread westward and is now found throughout the ceded territories of Minnesota, Wisconsin, and Michigan (Fig. 1).

Purple loosestrife is an herbaceous perennial that prefers aquatic or wetland environments. A mature plant can grow to be 2.5m tall and anywhere from 30 to 50 stems can arise from a common rootstock. Root crowns can grow up to 0.5m in diameter. Reproduction is either vegetative or sexual, but seed production is the main avenue of plant dispersal. Blooming occurs from late July to early September in northern Wisconsin and Upper Michigan, with mature plants capable of producing over 2 million seeds annually. The principle route of seed dispersal is by floating on open water, however, long distance dispersal is also possible by seeds that become embedded in animal fur or feathers, truck or ATV tires, and outboard engines or live wells. Any moist exposed soil receiving diffuse sunlight provides favorable conditions for the germination of purple loosestrife seeds (Shamsi and Whitehead 1974). Germination sites are most often associated with recent disturbances that expose the soil such as road construction, reduction of water levels, and roadside mowing.

Healthy wetland ecosystems are characterized by a diversity of plant species and habitat structure. Alternating patches of thick vegetation and open water provide both food and cover for a diverse array of terrestrial and aquatic wildlife. Early observations have linked purple loosestrife to degraded water bird production sites (McKeon 1959). Loss of open water, mud flats, and wildlife food plants were observed ecological consequences of loosestrife invasion into wetland communities (Rawinski and Malecki 1984). Once established, purple loosestrife has the ability to out-compete native plant species in wetland habitats and form dense monotypic stands because it lacks the control mechanisms found in its native habitat. Prevention of loosestrife colonization and control of loosestrife infestations are necessary to maintain the health of wetland ecosystems.

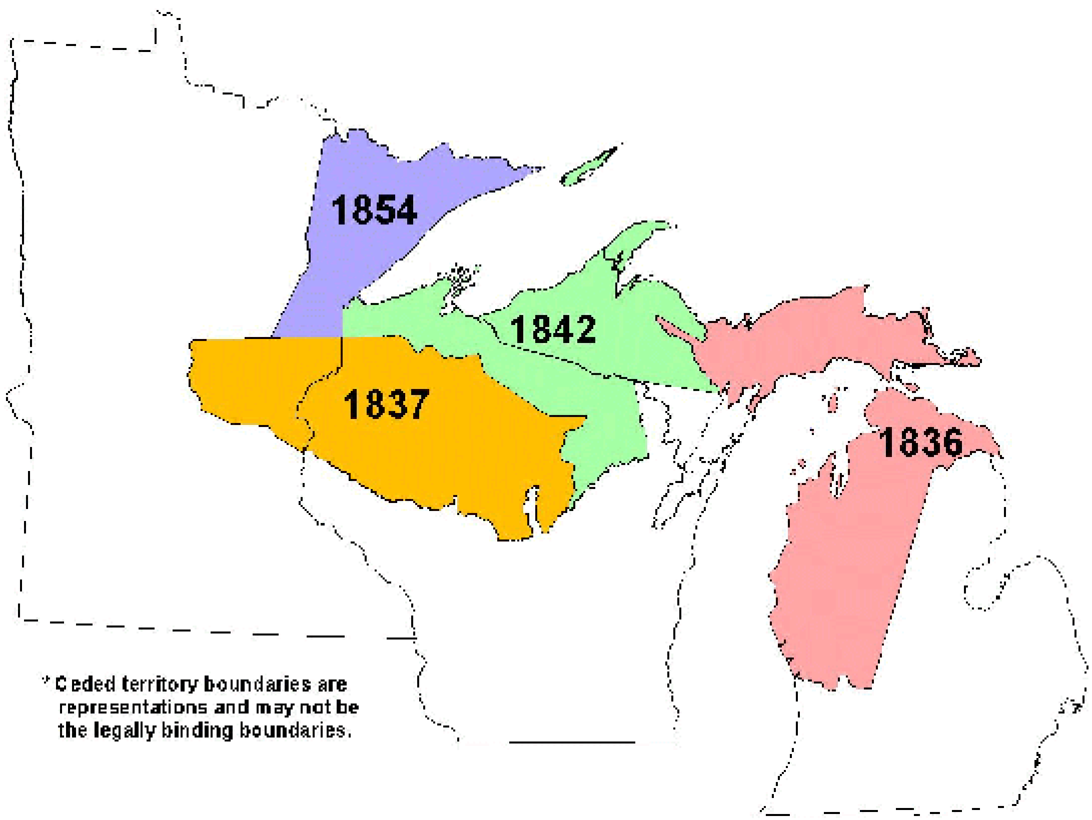

Figure 1. Ceded territories in Michigan, Wisconsin, and Minnesota.

CHAPTER 1

PURPLE LOOSESTRIFE SURVEY OF THE 1842 CEDED TERRITORIES IN UPPER MICHIGAN

The Michigan portion of the 1842 ceded territory is important for controlling the further spread of purple loosestrife because its watersheds drain into 3 major water bodies: 1) Lake Superior, 2) Lake Michigan, and 3) the Wisconsin River. The first GLIFWC survey of Michigan's 1842 ceded territory for purple loosestrife was conducted in 1995 (Edblom et al. 1995), and focused on the Sturgeon River Sloughs Wildlife Area in Baraga and Houghton counties. The primary objective of the 1996 survey was to determine the distribution of loosestrife infestation throughout the 1842 ceded territory in Michigan. A secondary objective was to quantify and describe (areal extant, density, and potential for spreading) each colony. By establishing a baseline of locations, areal extant, and relative density of purple loosestrife colonies in the western U.P., future control efforts can be effectively directed and prioritized.

METHODS

Although the distribution of purple loosestrife in the western UP was undocumented, local natural resource agency personnel were aware of some loosestrife locations within their jurisdictions. A contact list was developed (Appendix 1), and each person was contacted in an effort to collect as much information as possible prior to initiating field inspections.

Purple loosestrife locations were initially mapped based on verbal descriptions, written notes, and maps submitted by local contacts. USGS topographic maps were obtained and key areas were copied for field use. Once a potential site was located on a map, routes of seed dispersal (connecting waterways, roads, etc...) and potential colonizations sites (adjacent wetlands, boat launches, dams, etc...) were identified for field inspection.

Data sheets were developed for recording information on each purple loosestrife colony (Appendix 2). County, quadrangle map name, and legal description were recorded for the most infested sites. Briefer descriptions were recorded for smaller roadside sites. The area of infestation was determined by ocular estimation. Density was determined as a percentage of the surrounding area covered by purple loosestrife (Curtis 1959) and was grouped into categories: very low (<5% cover), low (5-10% cover), medium (10-50% cover), and high (>50% cover). Purple loosestrife plants were classified by stalk characteristics following the methods of Thompson et al. (1987).

Potential dispersal routes and nearby wetland communities perceived to be at risk of colonization were also recorded for each site. Observations were made from a truck, bike, canoe, or foot depending on terrain and were assisted by using binoculars when appropriate.

RESULTS

The total area of purple loosestrife found in Michigan's 1842 ceded territory was estimated to be 1.8 km^2. Figure 2 illustrates the distribution and area of loosestrife colonies located and the routes surveyed during the 1996 survey. Table 1 summarizes the sites located during this survey and provides a key to the sites illustrated in figure 2.

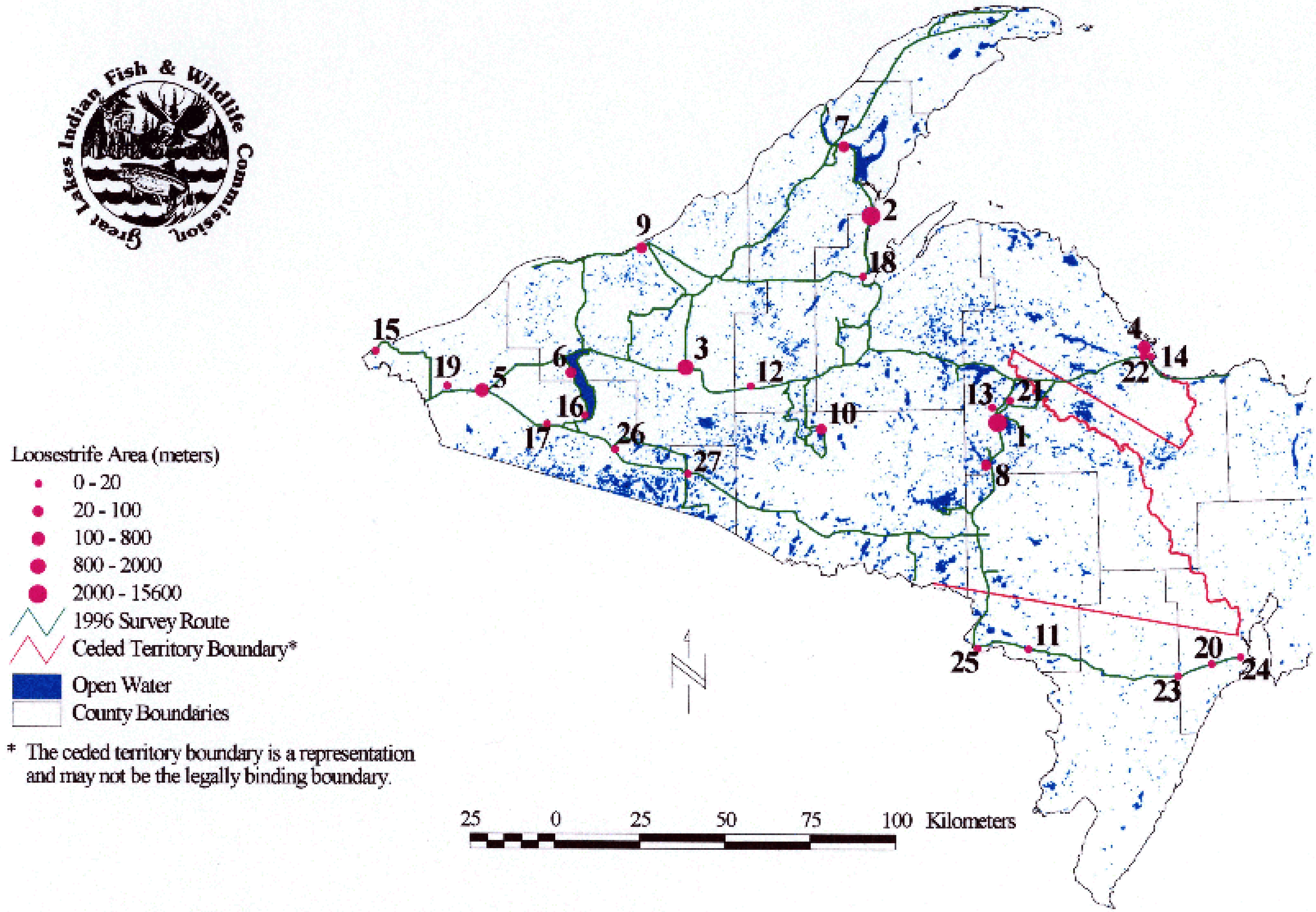

Figure 2. Distribution of purple loosestrife in the 1842 ceded territories of Michigan.

Table 1. Summary of locations, areal extant, and density of Purple Loosestrife populations located during 1996 survey of 1842 ceded territory in Upper Michigan.

ID*	County	Quad	T	R	S	Area (m^2)	Density	Notes
1	Marquette	Witch Lake NE	47N	29W 30W	1,2,27,35	156000	Low-High	20 km section of the Michigamme R., starting approximately 2 km N of Juncob L., S to Witbeck Rapids. It is a large river with many shallow bays east of Republic. Vast seed source with potential to infest numerous surrounding lakes including: Squaw, Horseshoe, Witch, Silver, Lake Ellen, and the Michigamme Res.
		Republic	46N	30W	1,6,7,18,19			
		Republic SW	45N	29W	19,30,31			
		Republic SW	46N	29W	5,7,8,18,19			
2	Baraga, Houghton					12800	Low - High	US-41: scattered spots along the road from Baraga to Houghton, with the highest density from Chassel to Houghton
3	Ontonagon	Bruce Crossing	48N	39W	15,16,21-23,26-28	1610	Low-High	N of junct. M28 and US-45. High concentrations along E and W side of US-45, 1.5 km N of M28 in roadside ditches. High density stand bordering the ball park.
4	Marquette	Marquette	48N	25W	9,10	800	Low-High	Fluctuating water levels due to hydro dams continually expose moist soils to loosestrife colonization within the Dead R. Basin. Heavily infested that will likely worsen because loosestrife is already colonizing shallows.
5	Gogebic	Wakefield	47N	46W	12(SE1/4)	700	High	Both sides of US-2 between the Black R. and N. Ramsay Rd. where run-off flows W into the Black R. On the S side of US-2 loosestrife followed a narrow ditch ending in a culvert. Culvert empties into a small wetland that is heavily infested with class 2 and 3 plants.
6	Ontonagon	Marshall Creek	47N	42W	8,17	100	High	W side L. Gogebic, on W side of M64, across from the Fisherman's Resort. Plants showed evidence of spraying by MDOT, flower spikes drooping but not necessarily dead.

* Refer to figure 2.

Table 1. (Continued)

ID*	County	Quad	T	R	S	Area (m^2)	Density	Notes
7	Houghton	Chassel	54N	34W	1(NW1/4)	45	Med	Corner of Sharon Ave. and Portage St. bordered on 2 sides by roads, no outlet, may be contained by urban development. Sporadic control efforts have been reported for this site in the past (Rob Aho, MIDNR, pers. commun.).
8	Marquette	Witch Lake	45N	35W	14(NW1/4)	40	Low	Island L., SW corner of Marquette Cnty, off Forest Rd. 601. Numerous private homes, no public access. Several plants found on island. A waterway connecting Island L. with Pickerel L. may provide a dispersal route, however, it is unknown which way the water flows, or if Pickerel L. contains loosestrife.
9	Ontonagon	(Roadside)				30	Med	M64; 0.5 km W of Ontonagon, near junct. of Norwich Rd. on S side of the road.
10	Iron	Perch Lake	46N	35W	22,23	30	Low	Inlets include Wolf and Kidney Crks and outflow is via the Perch R. Lakeshore has numerous private homes and a USFS campground and boat launch. L. St. Kathryn and Norway and Cable L., are potential seed dispersal sites.
11	Dickinson	(Roadside)				20	Med	US-2; private gardens in Norway across from Amoco
12	Houghton	Kenton	47N	37W	10(NW1/4)	15	Low	360 m E of Jumbo Crk on M28. Water flows from the ditches into Jumbo Crk, Jumbo Crk and E Branch of Ontonagon R. potential dispersal routes. Jumbo Crk is a slow, shallow creek with wide flood plains and low banks.

* Refer to figure 2.

Table 1. (Continued)

ID*	County	Quad	T	R	S	Area (m^2)	Density	Notes
13	Marquette	Witch Lake	47N	30W	35, 36	15	Very Low	Juncob L. flows into Michigamme R. No public access, but permission obtained by property owners to survey the lake. Loosestrife found in very low density, with < 10 plants. Michigamme R. already infested. Juncob L. has wide, shallow shoreline. Information exchanged with property owners.
14	Marquette	Marquette	48N	25W	22,23	10	Low	A single class 1 plant at the mouth of Whetstone Crk. on the shore of L. Superior. Other plants were found at the junct. of McClellan Ave. and a set of railroad tracks.
15	Gogebic					7	Very Low	Little Girl's Point; 14 km N of junct. of 504 and US-2
16	Gogebic	Marshall Creek	46N	42W	4(SE1/4)	7	Low	W of M64 across from entrance to L. Gogebic Cnty Park at the south-west corner of L. Gogebic. Loosestrife found in low densities in a ditch. Greatest number of plants found near culvert that diverts water into ephemeral creek that empties into a wetland on the S end of L. Gogebic during heavy rain or spring run-off events.
17	Gogebic	(Roadside)				4	Very Low	Marinesco; N of Marinesco on corner of "Old and New" US-2
18	Baraga	(Roadside)				4	Low	US-41; 1/3 mile south of the M38 and US-41 junct.
19	Gogebic	(Roadside)				2.50	Very Low	Powderhorn Rd.; <0.5km N of US-2, N of Ironwood
20	Delta	(Roadside)				2	Very Low	US-2; just W of Hyde in front gardens of the Highland Golf Course
21	Marquette	(Roadside)				2	Very Low	Near Republic; 1km E of the junct. of Forest Rds. 478 and 601, on Forest Rd. 478.

* Refer to figure 2.

Table 1. (Continued)

ID*	County	Quad	T	R	S	Area (m^2)	Density	Notes
22	Marquette	(Roadside)				1.50	Very Low	Marquette; less than 1/4 mile west of the Business Loop of US-41 and M28.
23	Delta Menominee	(Roadside)				1	Very Low	US-2; East Time Zone / cnty line junct. on N side of road
24	Delta	(Roadside)				0.75	Very Low	US-2; 1 km W of US-2 junct. and N 30th St. in Escanaba
25	Dickinson	(Roadside)				0.50	Very Low	Kingsford: corner of Brookfield and Westwood, on NW corner of intersection
26	Gogebic	(Roadside)				0.25	Very Low	US-2; <0.5 km W of the Cisco branch of the Ontongon R.
27	Gogebic	(Roadside)				0.25	Very Low	Junct. US-2 and US-45, USFS visitor ctr.

* Refer to figure 2.

DISCUSSION

Due to a cold, late spring during 1996, purple loosestrife flowering dates were delayed by several weeks in Upper Michigan. Consequently, the survey period was restricted to only 3 weeks. Each location provided by contacts was surveyed during this time. Although loosestrife was not found at every site, many additional locations were discovered en route, where it was often found growing in roadside ditches or as ornamental plants in private lawns and gardens.

Large and extensive infestations located during the 1996 survey occurred in Marquette, Baraga, Houghton, Ontonagon, and Gogebic counties (Table 1, ID nos. 1-5). These sites, all over 500 m^2, will probably be controlled best biologically using herbivorous beetles. The remaining sites on the list may be controlled by hand-pulling or herbicides where appropriate.

Purple loosestrife infestation within Michigan's 1842 ceded territory is relatively light in comparison to lower Michigan and Wisconsin. Purple loosestrife distribution in Upper Michigan might be contained by establishing partnerships between natural resource agencies, volunteer groups, and the general public. Efforts need to be directed towards 1) prioritization of sites for control, 2) control, and 3) increasing awareness of the problem to help monitor and prevent further spreading. The information compiled during this survey will contribute toward these goals.

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CHAPTER 2

HIGHBRIDGE STUDY PLOTS

During the GLIFWC survey of the Bad River watershed, Gilbert et al. (1995) reported the greatest densities of purple loosestrife near Highbridge, Wisconsin. Purple loosestrife densities averaged 3.73 plants/m^2 over a 80 hectare area. This colony was a significant seed source for Silver Creek, the Marengo River, and ultimately the Bad River and the Kakagon Sloughs.

GLIFWC control crews have treated (apparently successfully) numerous acres of loosestrife-infested wetlands beginning in 1989 (Gilbert et al. 1995) using backpack sprayers to apply Garlon 3A. However, the efficiency of backpack sprayers and the effectiveness Garlon 3A has not been quantified. Five study plots within the Highbridge loosestrife population were studied to quantify the effectiveness and efficiency of Garlon 3A and backpack sprayers, respectively.

METHODS

Permission was obtained from 2 landowners to set up study plots and apply herbicide to purple loosestrife on their properties. Study plots were chosen based on loosestrife density, hydrology, and topography. Each plot measured 100 m^2 and all plots were aligned with the cardinal directions. Four of the plots, (1,2,3,5) measured 10 x 10m, and the remaining plot (#4) measured 5 x 20m. Plots were delineated with corner posts and string.

Two of the 5 plots were located in cattail communities with standing water. The 3 remaining plots were located in a tussock meadow where willow, alder, horsetail, grasses, and sedges comprised the dominant native plant community. Standing water was present in low-lying areas of these plots. All plots were subject to flowing water during high run-off events.

Prior to treatment, vegetation within plots was quantified (Appendix 3) within 1m^2 subplots spaced at 1m intervals along east-west transects. Each loosestrife plant within a subplot was counted and classified following the method of Stuckey et al. (1987). For non-target plants, percent coverage was estimated by species.

Plots were treated with 2-3% Garlon 3A solution applied with a backpack sprayer. The time spent applying herbicide, amount of herbicide solution used, and the number of people applying herbicide were recorded for each plot.

Plots were surveyed again ~20 days after treatment (Appendix 4). The same methods were used on each plot to determine the percent of purple loosestrife and other vegetation killed. Plants were considered dead if they appeared completely brown and limp.

RESULTS

The mean density of purple loosestrife over all plots declined from 22.75 plants/m^2 to 2.0 plants/m^2 (91%) (Table 1.) Reduction by plant class was 92% for class 1, 75% for class 2 and 99% for class 3 (Table 1.). The mean time spent applying herbicide was 2.78 minutes/m^2 (Table 2.) The mean volume of Garlon 3A solution used was 0.28 gallons/m^2 (Table 2.). Jewel weed, willow, bulrush, and grass/sedge were the most sensitive non-target species with mean reductions of 100, 78, 47, and 43%, respectively (Table 3).

Table 1. Pre and post-treatment plant densities of Highbridge study plots.

Plot No.	Class 1 Plants (plants/m^2)		Class 2 Plants (plants/m^2)		Class 3 Plants (plants/m^2)		Total Density (plants/m^2)		Mean Reduction (%)
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
1	6.89	0.84	1.58	0.44	0	0	8.47	1.28	84.89
2	41.42	5.68	1.60	0.64	0	0	43.02	6.32	85.31
3	33.12	1.40	0.58	0.06	0	0	33.70	1.46	95.67
4	25.20	0.74	0.82	0.12	0.46	0.01	26.48	0.86	96.75
5	0.84	0.06	0.64	0.04	0.06	0	2.06	0.10	95.15
Means	21.50	1.74	1.04	0.26	0.21	0	22.75	2.00	91.21
Mean Reduction (%)		92		75		99		91	

Table 2. Time spent spraying and volume of herbicide used to treat purple loosestrife in Highbridge study plots.

Plot #	No. of Persons	Total Time (minutes)	Time/Person (minutes)	Volume of Herbicide Solution (Gallons)
1	1	21	21	2
2	1	25	25	4
3	3	33	11	3
4	1	29	29	2.6
5	2	30	15	2.6
mean/plot		27.8	20.2	2.8

Table 3. Pre and post-treatment effects on percent coverage of non-target plants.

Species	Plot No. 1		2		3		4		5		Mean Reduction (%)
	pre	post	pre	post	pre	post	pre	post	pre	post	
Willow	3	1	8	1	5	1	0	0	0	0	78
Dogwood	1	1	4	1	5	3	0	0	0	0	38
Aspen	0	0	1	1	1	1	0	0	0	0	0
Grasses/ Sedges	75	70	25	20	37	30	45	5	15	3	43
Bulrush	1	1	1	1	2	1	15	1	10	1	47
Cattails	0	0	0	0	0	0	50	37	70	70	13
Sensitive Fern	17	17	27	27	0	0	0	0	0	0	0
Milk Weed	0	0	0	0	1	1	0	0	0	0	0
Wild Strawberry	2	2	30	30	3	3	0	0	0	0	0
Joe-pie Weed	0	0	0	0	1	1	0	0	0	0	0
Jewel Weed	0	0	0	0	0	0	0	0	7	0	100
Duckweed	0	0	0	0	0	0	0	0	1	1	0
Goldenrod	35	35	10	5	5	5	0	0	0	0	17
Angelica	1	1	1	1	0	0	0	0	0	0	0
Horsetail	0	0	47	47	2	2	0	0	0	0	0

DISCUSSION

The information gathered during this study may be useful for projecting the costs and benefits of future control efforts in similar situations. However, these data were collected from an easily controlled population located in open fields, with good road access. Purple loosestrife colonies can become well established and are often found far from roads in thickly vegetated wetland areas where access is difficult. In addition, backpack sprayers did not require refilling for the plots we treated. Large colonies will require more herbicide and the added time it takes to refill backpack sprayers. These data will be useful for planning control efforts along roadways (a major route of loosestrife dispersal) but will underestimate the effort required to control large infestations in less accessible habitats.

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Gilbert, J., B. Carlson, and R. LaRue. 1995. Purple loosestrife survey of the Bad River watershed, 1994. Great Lakes Indian Fish and Wildl. Comm. Admin. Rep. 95-01. 27pp.

APPENDIX 1

Contact List

Rob Aho	MIDNR, Baraga
Pat Clark	MIDNR,Wakefield
Bob Evans	Ottawa National Forest,Watersmeet
Dave Ewert	The Nature Conservancy-Lansing
Jim Hammill	MIDNR, Crystal Falls
John Hendrickson	MIDNR, Marquette
Bob Johnson	Ontonagon County Forest Service
Ron Kinnunen	Michigan Sea Grant, District Agent
Jill Lucero	Ottawa National Forest, Kenton
Colleen Mutula	Ottawa National Forest, Bessemer
Karen Nash	Ottawa National Forest, Ironwood
Valerie Novak	Michigan DOT, Crystal Falls
Bruce Peterson	MIDNR, Hancock
Jan Schultz	Hiawatha National Forest, Marquette
Bob Sprague	Porcupine Mountains State Park
Walt Summers	Natural Resources Conservation Service, Kingsford
Jim Sweeting	Waterfowl Consultant
Gary Willis	Private Forest Consultant
George Beck	Lac Vieux Desert Band of Lake Superior Chippewa
	Lake Gogebic State Park

APPENDIX 2

DATA SHEET-MI

PURPLE LOOSESTRIFE
1996 Upper Michigan Data Sheet
1842 Ceded Territory

Date:___________ Observers:______________________________

County:________________________________ UTM Coordinates:_______________

Location:_______________________________ Quad:_______________________
_______________________________________ T:_____R:_____S:_____1/4:____

Habitat:
Plant Community:____
Canopy Type:____

Hydrology:____
____

Site Disturbances:____

Potential Seed Source:____
Potential Seed Dispersal:____

Plant Class/Estimation of Infestation:

Class1:_______, Class 2:______, Class3:______

Estimation of Density:__________________________
Total Area of Colony:___________________________

Comments, Observations, & Sketch:

APPENDIX 3

PRE-SPRAY DATA SHEET-HIGHBRIDGE

PURPLE LOOSESTRIFE
1996 Highbridge Data Sheet
(Pre-treatment)

Date:______________ Plot #:__________ Landowner:_______________________

Observers:______________________________ UTM Coordinates:________________
Location:______________________________
____ T:_____R:_____S:_____1/4:____

Habitat:
Plant Community:____
Canopy Type:____
Soil Type:____

Hydrology:____
____

Site Disturbances:____

Potential Seed Source:____
Potential Seed Dispersal:____

Plant Class/Density:

Class 1:____________/m²
Class 2:____________/m²
Class 3:____________/m²
Total Density:____________/m²

Comments, Observations & Map:

APPENDIX 4

POST-SPRAY-HIGHBRIDGE

PURPLE LOOSESTRIFE
1996 Highbridge Data Sheet
(Post-treatment)

Date:_______________ Plot #:__________ Landowner:________________________

Observers:________________________________ UTM Coordinates:_________________
Location:________________________________
____ T:_____R:_____S:_____1/4:____

Habitat:
Plant Community:____
Canopy Type:____
Soil Type:____

Hydrology:____
____

Site Disturbances:____

Potential Seed Source:____
Potential Seed Dispersal:____

Control Measures:____

Plant Class/Density: (Remaining Plants)

Class 1:____________/m²
Class 2:____________/m²
Class 3:____________/m²
Total Density:_____________/m²

Plant Class/Density: (New Plants)

Class 1:____________/m²
Class 2:____________/m²
Class 3:____________/m²
Total Density:_____________/m²

Comments, Observations & Map: